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ABSTRACT

Vertical and lateral integration are two important nervous system integrations that affect the development of oral behaviors. There are three progressions in the vertical integration process for speech nervous system development: R-complex speech (ritualistic, memorized expressions), limbic speech (emotional expressions), and cortical speech (reasoning or logical expressions). Multimodality loss of language (aphasia) due to stroke results in deficits in auditory comprehension, speaking, reading, writing and mathematical calculation, but not in intellect. Characteristics common to aphasias are reduction in available vocabulary and release of lower speech center response (limbic and R-complex speech). A second type of cerebral infarct commonly affecting linguistic abilities is head trauma, producing cognitive-linguistic deficits, rather than aphasia. Symptoms might include impulsivity, reduced attention span, reduced retention for new learning, egocentric orientation in expression, and release of lower-level speech responses. The assessment of written language of those with neurogenic communication disorders is usually dictated by the degree of motor and visual involvement. However, in cases where residual abilities are demonstrated, informal assessment should entail observations of writing mechanics, spelling, punctuation, syntactic complexity, and pragmatics. Remediation for those with neurogenic disorders should be structured in the following way: (1) prewriting (tracing and copying); (2) writing words; (3) writing sentences; and (4) writing sentences in paragraphs--keeping in mind that writing should be facilitated through continuous, patient-appropriate stimuli which encourage self-monitoring and discovery of linguistic constructs. (HOD)

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Panel: NEUROLINGUISTIC PROGRAMMING AND RESEARCH IN COMMUNICATION DISORDERS: IMPLICATIONS FOR TEACHING/LEARNING WRITING.

Paper: NEUROGENIC COMMUNICATION DISORDERS AND PARALLELING AGRAPHIC DISTURBANCES: IMPLICATIONS FOR CONCERNS IN BASIC WRITING.

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Over the past few decades research has indicated that oral language deficits may preclude written language deficits. Orton(1925, 1928, 1937), a neurologist,found that students who display reading (receptive written language) and writing (expressive written language) deficits have problems with oral language,also. Since Orton's suggestion that oral language problems precede written language deficits research has tended to focus upon reading rather than writing disabilities (Boder, 1971; Mattis, French, and Rapin, 1975; Rourke, 1976; Satz, Taylor, Friel and Fletcher, 1978; Vellutino, 1979; Benton, 1978).

A search for the brain-behavior relationships involved in written language disturbances has lead researchers to compare the performance of brain-injuredchildren and adults to written language disabled populations (Mattis et. al., 1975; Rourke, 1976). By comparing neuropsychological performances of such populations investigators have found that speech-language deficits represent a high percentage of the underlying disorder.

Current research is focusing upon the auditory processing aspect of language as the primary culprit in written language disabilities (Tallal and Piercy, 1973, 1974,1975; Tallal and Stark, 1976; Tallal and Newcombe, 1978; Tallal, Stark, Kallman and Mellits, 1980). Such research seems to indicate that persons displaying reading and writing disturbances akin to dysphasia (faulty developmental language) are

slower processors of linguistically significant information.

Brain-Behavior Relationships in Oral Language

Being that oral competencies are in question relative to written language disturbances it appears important to discuss the neurobehavioral correlates of oral language. A trace of the evolution of the human nervous system indicates that bipedal walking and talking are the height of central nervous system (CNS) development (Lenneberg, 1967; Mysak, 1968, 1980; Darley, Aronson and Brown, 1975). Jackson (1958) discusses two important nervous system integrations which affect the development of oral (talking) behaviors. They are vertical and lateral integration of the nervous system.

Vertical Integration in Oral Language Development:

Vertical integration suggests that lower more simple nervous system responses are incorporated into higher system responses. Thus, for the act of speech, subcortical and brain stem behaviors are integrated and brought under the direct control of cortical structures.

There are three progressions in the vertical (upward) integration process for speech nervous system (SNS) development (Mysak, 1968, 1980). The first and lowest SNS process is "R-Complex Speech," which is ritualistic, memorized and social- gestural expression. Examples include chants, nursery

rhymes, pledges. The second and more progressive SNS process is "Limbic Speech," which represents emotional expression including fear love and hate forms, such as political appeals or love proposals. The third and highest of vertical integrations for the SNS is "Cortical Speech." Cortical speech represents reasoning or logical expressions in conversation, description, narration and persuasion. Mysak (1980) shares the following as exemplary of vertical integration and elaboration of lower systems by higher systems:

> The progressive integration and elaboration of the lower levels of language by the cortical level may be demonstrated in cortical speech used in a proposal of marriage, for example. A true cortical speech proposal begins with a logical argument why the individual should agree to marry. If that doesn't appear to be going well, the cortex may engage in limbic speech or romantic love talk; if that doesn't work, the cortex may use not only cortical and limbic speech, but also resort to R-Complex talk composed of repetitive and chant-like, "why don't you want to?", "ya gotta," "Oh please," and so on.
> (Mysak, 1980 p.57)

Lateral Integration in Oral Language Development:

Occurring somewhat simultaneously with vertical integration of SNS development is lateral integration. Lateral integration is a process peculiar to the cerebral cortex (brain). Lateral integration allows the right cerebral hemisphere (generally specializing in musical and spatial relations) to communicate with the left cerebral hemisphere (usually the language dominant half of the brain) (Penfield, 1966; Roberts, 1966; Geschwind, 1979). The spatial informa-

tion of the right hemisphere is labelled and "verbally mediated" by the language dominate left hemisphere. A second aspect of lateral integration is its occurrence within each hemisphere. For our discussion of oral language, however, only the lateral integration of the left (language dominant) hemisphere is considered.

The language dominant hemisphere can be divided into three primary aspects which communicate with one another in a laterally integrative manner. They are the inferior, posterior and frontal portions of the left cerebral hemisphere and are pictured in Figure 1.

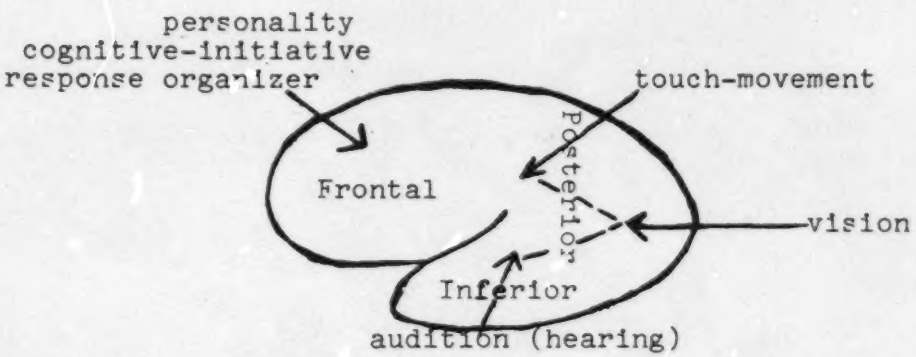

Fig. 1

The inferior aspect is the auditory association cortex which is responsible for the attachment of meaning to speech sounds (phonemic symboliation). The posterior area is a juncture of the senses including audition(hearing) vision, and touch-movement. It is considered the language association

area. Semantics (vocabulary-word meaning) and syntax (word order) are attached to the phonemic symbols of the auditory cortex at this posterior juncture. This area's major function is the attachment of linguistic symbols to current and reminiscent sensory experiences. The language association area allows us to engage in "mind talk," that is, inner language. This inner language manipulation permits the mind's ear to hear what one wants to say, the mind's eye to picture the words and symbols for them, and the mind's sensor to use descriptive verbiage in defining sensory experiences.

The inferior and posterior aspects of the language dominant hemisphere are exclusively sensory interpretive centers. Sensory experiences must be transmitted to the frontal cortex if thoughts are to be expressed. The frontal cortex is the motor programmer, personality center, and the organizer during expressive activities. The frontal cortex weighs and considers information from lower centers (Limbic and R-Complex) as well as from the more lateral posterior aspects of the cerebral hemisphere (sensory areas) (Damasio, 1979). It then executes an expressive program for purposeful and well organized behavior.

Coordination of Lateral and Vertical Integration for Oral Language Behavior:

In general, lateral integrative processes permit cognitive-linguistic associations. That is, the conceptualization and programming of language output are by-products of lateral integration. The conceptualization of thought is a whole

brain activity (including both hemispheres). It involves sensory perceptions, memory and cognitive processing in the generation of feelings ideas and desires to be expressed. Thus, the lower speech centers (limbic and R-Complex) ruminate upward to the cerebral cortices screaming their desires for expression. The language dominant cortex considers lower system demands to speak, screens them and then engages higher-cognitive strategies for expression or externalization of thought. It is this cortical-cognitive-linguistic interplay which permits logical, sequential and wellorganized expression of thought.

Neurobehavioral Overlap of Oral and Written Language

Oral and written language are modes of expression which are the result of laterally integrative processes. That is, they both require active input (sensory-receptive) and inner-language manipulation. The primary mode for learning oral communication is audition (hearing), while the primary mode for written language learning is visual (reading). As suggested in Figure 2 both written and oral expression, once learned, may be stimulated by other sensory modalities. Thus, I may hear and write rather than speak. Conversely, I may read and speak rather than write.

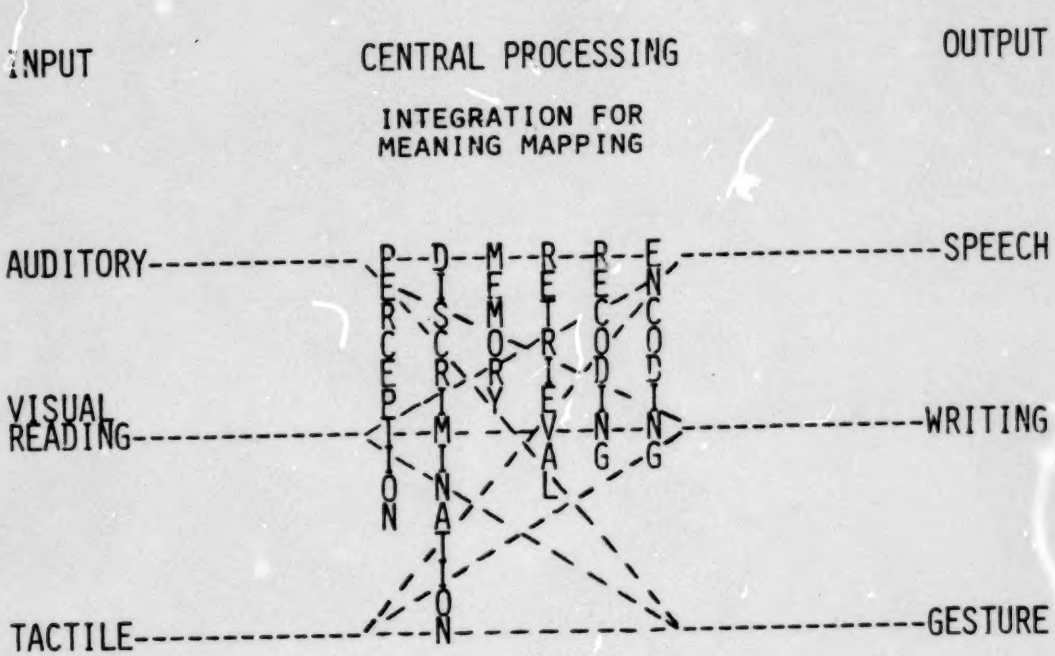

Fig. 2

Also notable in Figure 2 is the central processor which pulls on the whole brain for thought conceptualization. The central processor integrates external (auditory/visual etc.) and internal (cognitive attitude) stimuli in the generation of thought. In both oral and written language one must be capable of attending (perceiving-discriminating), retrieving associative information from memory, and translating thoughts to outward expression (recoding-encoding). The speaker/writer must be knowledgeable of linguistic constraints upon the content (semantics/meaning), form (phonetic/graphemic, syntactic) and use (pragmatics) in speaking and writing.

Writing as Elaborative of Oral Symbolization:

Although oral and written expression share brain-behavior and neurolinguistic avenues of activation, it is recognized that writing is not simply oral language in print (Lieberman, and Shankweiler, 1979). Writing is the highest form of linguistic symbolization requiring a tacit awareness of and formal training in language constructs. Unlike the speaker, who has immediate corrective access to an audience, an author must be assured that everything, from puctuation and spelling to text cohesion, displays the intended meaning to an anonymous audience. Thus, a writer must develop a "metalinguistic" sense about the act of writing. That is, an author must be able to express inner thoughts by making conscious choices about unconscious linguistic processes. The writer must have facility with:

1. how to organize connected sentences (text cohesion) in a style conveyant of the writer's intent to share information, protest, clarify, create, persuade, or record events;
2. intuiting the needs of the anonymous audience so that old and new information are relevantly, cohesively, and coherently shared;
3. how to use vocabulary (semantics) creatively, accurately, and interestingly;
4. how to use sentence structure (syntax) in prioritizing and emphasizing information;
5. how to spell.

Neurogenic Disorders and Their Affect on Speaking & Writing

Aphasia:

Multi-modality loss of language (aphasia) due to stroke results in deficits in auditory comprehension, speaking, reading, writing and mathematical calculation (Schuell, Jenkins, Jimenez-Pabon, 1967). However, aphasia is not an intellectual deficit. Although several aphasia syndromes appear to exist (Goodglass and Kaplan, 1976; Kertesz, 1979), they will not be discussed as such in this text. Instead, a general trichotomy of anterior (Frontal), posterior and subcortical aphasias will be delineated.

Anterior aphasics are characteristically dysfluent and telegraphic speakers. They tend to exhibit better language comprehension than oral expression abilities. Phoneme (speech sound) confusions frequent their oral language. Two examples of the oral language of anterior aphasia include:

1. The patient who wants to say "Pipe," and produces the following phonemic errors;
   "Hike -- No, No, No, -- Pike -- No, Pipe -- Yes, Yes, Pipe."

2. The patient who describes a visit to the dentist in the following telegraphic manner:
   "Dentist -- G-Go -- chair -- soof -- toof-- -- tooth (Goodglass, and Kaplan, 1976 p.61).

Unlike the anterior aphasias, posterior aphasics are fluent speakers displaying comprehension deficits and word (semantic) substitution errors. Their oral language is often

empty with many circumlocutions. In describing a picture of children sneaking cookies a posterior aphasic produced the following:

> "Well this is . . . mother is away here working her out o' here to get her better, but when she's looking, the two boys looking in there other part. One small tile into her time here. . ."
> (Goodglass and Kaplan, 1976, p. 61)

There exists a sense of grammaticality in posterior aphasic productions. Severe cases of inferior brain involvement in this group of aphasias are characterized by their "neologisitic jargon." The patient is stringing phonemes together with juncture and intonation resembling words and phrases, but it sounds nonsensical. A striking feature of moderate to severe aphasias is that patients act as if they are making perfect sense.

The last type of aphasia is subcortical. Like the posterior aphasias, subcorticals are characterized by semantic substitutions (paraphasias) and circumlocutory responses. However, word retrieval strategies and general memory problems pervade in subcortical aphasia. Subcorticals display faulty filing systems, so that they start to speak indicating familiarity with a topic and then lose the words to express their thoughts. When asked what was eaten for breakfast, subcortical aphasics might respond: "It was delicious with --oh, let me see -- I know what it is -- oh, I can't say it -- it was perfect." Organization strategies, including sequencing and categorizing, are difficult.

Characteristics common to the aphasias are reduction in available vocabulary and release of lower speech center responses, that is,Limbic and R-Complex speech. Being that the once laterally integrated cortex experiences dissolution, more automatic speech (non-propositional) is released. Thus, counting, naming days of the week, and swearing are more easily produced and available than is spontaneously creative (propositional) speech.

Written expression often parallels oral speech output when motor involvements are minimal in aphasia. Global and anterior brain involvements often present complicating motor difficulties in aphasia, so that, writing at a practical or functional level is difficult. Alexia (inability to read written language symbols) and agraphia (inability to write language symbols) are often concomitant in the aphasias, and add to writing difficulties.

Closed Head Injury:

A second type of cerebral infarct commonly affecting linguistic abilities is head trauma. Localization of brain-behavior relationships in this population is difficult because lesions tend to be more diffuse. Patients suffering such injuries show cognitive-linguistic deficits, rather than aphasia. General symptomatology includes impulsivity, reduced attention span, reduced retention for new learning, egocentric orientation in expression and release of lower-level speech responses.

Closed head patients display deficits in the following cognitive-linguistic integrations both orally and ir written language tasks:

1. Sequential synthesis (ordering oral and written language)
2. Discovering missing premises when given a conclusion
3. Determining analogous relationships which requires facility with synonymity and antonymity in language constructs
4. Ferreting relevant from irrelevant information in problem-solving
5. Asking appropriate and sequential questions for problem solving
6. Deductive reasoning.

Remediational Principles as Applied to Writing

The speech-language pathologist's primary responsibility is the diagnosis and facilitation of oral language and auditory comprehension in neurogenic communication disorders. Reading and writing are employed as adjuncts to intensive auditory stimulation.

In neurogenic populations written language assessment is usually dictated by the degree of motor and visual involvement. However, in cases where residual abilities are demonstrated, informal assessment entails observation of writing mechanics, spelling, punctuation, syntactic complexity, pragmatics and text cohesion.

Remediation is structured in a fashion that moves from:

1. Prewriting (tracing and copying)
   a. geometric forms, letters, numbers
   b. words with associated pictures
   c. words

2. Writing Words
   a. from picture identification
   b. in automatic phrase completion ,e.g. " a cup of _____."
   c. to dictation
   d. in proposition phrase completion, e.g. "He used the black_____"
   e. in paragraph text completion

3. Writing Sentences
   a. reordering (N + V + N) to more complex structures

4. Writing sentences in paragraph
   a. reordering given sentences
   b. recalling and re-writing ordered sentences
   c. writing short paragraphs about everyday events
   d. writing explanations in 2-4 related sentences
   e. writing when given a theme.

A basic principle used in working with the neurogenic population is that the pathologist act as a facilitator rather than teacher. Presentation of stimuli is continuous and patterned to fit the needs of individual clients. Corrective strategies are minimalized, while self-monitoring and discovery of linguistic constructs are maximalized.

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